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USING A HELICOPTER FOR DUSTING FOREST SOURCES OF TICK-BORNE ENCEPHALITIS*

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The intensive development of industry and agriculture in the eastern regions of the Soviet Union requires that public health bodies solve many problems connected with protecting the life and health of the people from dangerous diseases. Among them, the struggle with the carrier of tick-borne encephalitis - the taiga tick Ixodes persulkatus, p. Sch. - is indisputably one of the first concerns.

At the present time, ticks in nature are destroyed by aerial dusting of the area with 10% DDT dust at a consumption rate of 50

**Besides the authors, coworkers of the Ye. I. Martsinovskiy Institute of Medical Parasitology and Tropical Medicine - M. A. Laryukhin, Ye. N. Krivtsova, T. S. Yershova - and of the State Scientific-Research Institute of the Civil Air Fleet - S. S. Kish and G. N. Orlova - took part in carrying out the works.

kg/hectare [5, 1]. An agricultural version of the AN-2 airplane is used for this. Aerial spraying of these areas [3] is carried out exceedingly rarely because of the small amount of suitable preparations and the technical impossibilities of using aqueous mixtures during early spring cultivation.

Each year, 100-200 thousand hectares of tick-infested territory are treated with the aid of aircraft. However, this amount of work has not satisfied the existing requirements for a long time. Broadening the work is hindered by an insufficiency of the piston and also by the comparatively high cost of aerial dusting and the low efficiency of aerial methods. All of this is connected with the exceedingly high consumption rate of the preparation which, in turn, depends on the great losses of the powdered poisons in aerial application.

Abroad, the basic method of improving the economy of aerial-chemical operations is to increase the flight speed of aircraft and helicopters during treatment [8]. In trying to achieve the required quality of treatment under these conditions, the flight level is reduced (to 1 m above the area to be treated), which sharply increases the number of aerial crashes. It is clear that we shall not employ such a method, especially in considering the specifics of flight over forest cover. Indisputably, basic attention must be paid to developing ways of increasing the precipitability of the chemicals during aerial treatment.

In connection with that mentioned, the use of chemical pistons in a granular form [7] is very promising. However, at the present time, this method can not be definitely recommended because of the insufficiency of existing preparations. Another direction is to create conditions for depositing the already existing forms of chemicals: dusts, emulsions and so on [2]. The given work was carried out in this direction, in which the preparation most widely employed at the present time, 10% DDT dust, was used.

The problem of increasing the precipitability of easily-dispersed poisons probably can be solved by using helicopters. There is a group of reports attesting to the distinct advantages of these aircraft over airplanes [4, 6, 9, 11, 13]. These include the ability to reduce to a minimum flights for refuelling and for loading by selecting a runway in practically any place, the great speed range, exceptional maneuverability which conserves much time, and also the ability to carry out treatment in heavily broken and mountainous areas.

The main rotor of a helicopter throws down a powerful stream of air, while by increasing the flight speed, the direction of this stream inclines more and more towards the horizontal. Up to the present time, dusting has been done at high speeds (from 60 km/h and higher), despite the fact that there were indications [4] of the expediency of using lower flight speeds (25-40 km/h).

The advantages of flight at low speeds becomes especially clear in looking at how the chemical particles settle. Each particle, from the moment it is poured out into the air until the moment it collects on the surface is, for a given period of time, in free-fall in the atmosphere. However, in the free atmosphere, large fluctuations in the speed and direction of the wind take place. The movement of air in this case may be broken down into the horizontal and vertical components relative to the average wind [14]. When horizontal and rising air currents are present, the drop time of each particle increases and in addition, a tendency to drift in any direction arises. The higher the speed of the air streams, the more chemicals are lost in treatment. These losses are undesirable not only for economic reasons, but because of the toxic danger to people and animals.

When a helicopter flying at low speeds is used, the force from the downward air stream of the main rotor acts on the particles of the preparation. The influence of this stream, to a certain degree, must equalize the influence of natural air streams and help in decreasing the losses of chemical poisons due to meteorological conditions. Besides, the downward air stream should hinder retention of small

particles of the preparation on the crowns of trees and better deposit them on the grass and litter. This was confirmed by the successful experiment where a helicopter was used to remove snow piles from the crowns of trees [12].

Table 1. Technical-performance characteristics of an AN-2 airplane and the MI-1 helicopter.*

Factor	MI-1	AN-2
Amount of dust load (in kg)	300	1000
Flight speed during treatment (in km/h)	30-35	155-160
Speed during flights (in km/h)	80-100	155-160
Length of take-off run (in m)	-	180-250
Length of landing run (in m)	-	130-150
Take-off time (in min)	0.5	1.2
Landing time (in min)	0.5	0.7
Turn time (in min)	0.5	1.5
Daily sanitary norm for the flight (in h)	5	6

*Data taken from the handbooks of V. A. Nazarov, L. D. Lavrov, and I. V. Tropin [10].

The work was done using an MI-1NKh helicopter. The technical-performance characteristics of this device compared to those of the AN-2 airplane are presented in Table 1. The airplane has a significant advantage in load capacity and flight speed over the helicopter which, however, is compensated for in large measure by the ability to decrease the chemical consumption rate by using a helicopter flying at low speeds, because of the better particle precipitability and penetration under the forest canopy. Using a helicopter flying at 30-35 km/h during treatment, we succeeded in increasing deposition of the chemical an average of 2 1/2 times compared to the airplane. This enabled us to decrease the consumption rate of the preparation from 50 to 20 kg/hectare. Now, from a comparison of these characteristics it can be seen that if a signal load of dust in the airplane is sufficient for treating 20 hectares, then a helicopter load will provide treatment for 15 hectares. The difference, as we see, is very insignificant. Such features such as the time required for carrying

out different maneuvers (takeoff, landing, turns) make the helicopter economically more advantageous.

Adding to what was said, in treating large forests such as we have in Siberia, the Urals, and in the Far East, it is difficult and, in a majority of the cases, impossible to select a temporary landing field close to the section being treated. It is necessary to use permanent airdromes in large populated areas. Since, at the present time, vast zones of clear territory have already been created around a majority of these areas, the areas under treatment are even farther and farther away. This means that the airplane flight distance grows progressively, which sharply curtails the hourly productivity.

When a helicopter is used, it is practically always possible to select a landing field not more than 2 km from the section, where trucks will have brought the necessary amount of chemicals, fuel, and lubricants earlier.

The first test treatments were made in 1961 and they gave encouraging results, both in relation to effectiveness (destruction of adult ticks was 100%), and according to economic indicators. This made it possible to expand the works in 1962-1963 to the territory of the Yaysk rayon (Anzhero-Sudzhensk) in the Kemerovo Oblast'. The first year, the treatments were of a test-productivity character, and were carried out on a 56 hectare section. Based on the results derived, a supplement to the existing instructions on aerial treatment (publication of the State Scientific-Research Institute of the Civil Air Fleet, 1963) was established to check the new version. This check was made in 1963 at the Anzhero-Sudzhensk Sanitary-Epidemiological Station on an 853 hectare area*. Data on the effectiveness of treatment and also the economic characteristics and apparatus work factors are presented in Tables 2 and 3.

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*Coworkers of the Anzhero-Sudzhensk City Sanitation-Epidemiological Station V. I. Titorenko, L. V. Ruzayeva, N. M. Zubkova, and A. V. Gomzikov participated in carrying out the treatments.

Table 2. Effectiveness of test-production and production treatment.

Section	Number of sections	Area of section (in hectares)	Treatment date	Estimate of the number of adult ticks (average per dummy/h)	
				before treatment	after treatment
Nazarovka settlement	I	36	1/VI 1962	56.2	0
" "	II	20	4/VI 1962	30.9	0
Klentsovka village	I	406	1-3/VI 1963	12.3	0
" "	II	232	5-6/VI 1963	29.7	0
" "	III	215	8/VI 1963	38.0	0.4*

*Flaws are assumed during treatment.

Table 3. Economic characteristics and equipment work factors in dusting from an AN-2 airplane and an MI-1 helicopter.

Indicator	MI-1	AN-2
Dust consumption norm (in kg/hectare)	20	50
Dust consumption per second (in kg/s)	0.450	8.9
Width of working cover (in m).....	20-30	40-50
Permissible wind speed (in m/s).....	4-5	Not >2
Hourly productiveness (in hectares/h)	60	50*
Cost of treatment for 1 hectare**....	4 rubles, 5 kopecks	7 rubles, 55 kopecks

*According to production treatment data from the Anzhero-Sudzhensk City Sanitation-Epidemiological Station in March, 1963, on an 1140 hectare area.

**The calculations include the cost of the chemical poison (10% DDT dust) and payment for the aerial facilities, cost of transporting the dust and fuel and lubricants; payment for the workers and several other factors are omitted since they fluctuate greatly and are significantly small.

It is possible to add to Table 2 that a check made in 1963 of the condition of the section treated the previous year showed an absence of adult ticks.

In regard to safe wind speed (see Table 3), it should be noted that the 4-5 m/s rate is not absolute. Other indicators which characterize the condition of the free atmosphere have great meaning. Thus, with no rising air currents, we carried out treatment at a wind speed of up to 6.5 m/s, and stopped work when the wind interfered with the proper and safe operation of the helicopter. In addition, no reduction in the effectiveness indicators were noticed. At that time, poor settling of the preparation was also noted with lower winds.

For this reason, the presented data sufficiently convincingly attest to the advantages of carrying out aerial-chemical treatment of tick-infested territories from an MI-1 helicopter at low speeds (30-35 km/h). Such treatment gives great economy of the poisons, by means of which it is possible to treat additional areas. In addition, the cost for treating 1 hectare (compared to treatment by airplane) is lowered on account of the drop in the rate of consumption of the preparation, and the productivity increases because of the shorter flight distance from the landing field to the section and the ability to increase the treatment period per day. The obvious economic expediency in using a helicopter for the given work must be taken into consideration in planning treatments for 1964.

There is a basis for calculating that the economic advantages of carrying out treatment from helicopters will become more and more evident with the introduction of helicopters with large load capacities into production.

Conclusions

1. An increase in the volume of anti-tick measures will be slowed down by a shortage of chemical poisons and the high cost of aerial-chemical work, involving the exceedingly high consumption rate

of the preparation for 1 hectare. The latter, in turn, is explained by the great losses of powdered poisons when dusting from an airplane.

2. A helicopter has a number of advantages over an airplane: vertical flight ability, large speed range, exceptional maneuverability. Besides, at low flight speeds the helicopter creates a strong downward air stream which aids in better deposition of the chemical particles.

3. Tests on an MI-1 helicopter at speeds of 30-35 km/h showed the possibility for lowering the consumption rate of 10% DDT dust from 50 kg/hectare (when using an AN-2 airplane) to 20 kg/hectare. In addition, high treatment effectiveness was generally noted.

4. With the indicated use of a helicopter, a significant improvement in all economic factors was noticed (compared to those when using an AN-2 airplane). The cost of treating 1 hectare drops due to the decrease in the amount of preparation dusted. Hourly productivity may grow due to time saved on flights to the sections. In addition, the daily productiveness will grow due to the possibility of carrying out treatment in strong winds.

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ABSTRACT

(UNCL, 0) ABSTRACT OF REPORT. The MI 1HX helicopter was tested for spray dusting with a 10 percent DDT dust in tick borne encephalitis foci. During the period of spraying the flight speed of the craft was kept within limits of 30 to 35 km per hours. The improved precipitation of the chemical poison permitted it to reduce its consumption rate down to 20 kg per hectare, as compared with that (50 kg per hectare) accepted for the plane AN 2. The treatment remained highly effective. In addition to considerable savings of the poisonous material the reduction of consumption rates brought with it a substantial improvement of the present economic indices. This warrants recommending the new mode of the treatment for a wide scale field application in the foci of tick borne encephalitis. Orig. art. has: 3 tables.